

AN ^{754^a 5}
ESSAY
TOWARDS A ^{531. K.O.}
SOLUTION
OF THE
Horizontal MOON.

By HANS DE VEIL, A.B. Eman. Coll. ^K

Neque uno Luna rubens nitet Vultu. HOR.



NORTHAMPTON:
Printed by WILLIAM DICEY, 1725.

Y A S S E

T O W A R D S A

N O R T H O N

N O O N

By the Hon. J. B. Thompson, Secy.

of the Hon. J. B. Thompson, Secy.

of the Hon. J. B. Thompson, Secy.

of the Hon. J. B. Thompson, Secy.

of the Hon. J. B. Thompson, Secy.

of the Hon. J. B. Thompson, Secy.



THE
EPISTLE Dedicatory.
 TO THE
 Ladies of Northampton.



To GLORIES of Your County!
 As That is of ENGLAND:



IN order to alledge some
 Reason why this minute
 Piece of PHILOSOPHY
 crouds itself under your
Hoop-Petticoats for Shel-
 ter, 'twill be requisite to shew the
 Connexion between *Astronomy* and the

iv *Epistle Dedicatory.*

Fair-Sex : And sure 'tis no Wonder that, after having reach'd the Moon, I shou'd ambitiously fly to Stars of the greatest Magnitude. Indeed ev'ry Scribler has prefer'd the Ladies to the Stars in Point of Lustre---- But give me Leave to say that *Northampton* exceeds the Firmament in the Number of its Constellations; for such every Beauty there is, as being a Complication of Charms: Besides this, a certain *Wag* informs me there is a Posture as well agreeable to the Female Part of Human Kind as to the Practice of Stargazing; not to mention the peculiar Charms of Feminine Conversation when the *Sun* has resign'd his divided Dominion to the *Stars* and *Ladies*. How pleasing is it alternately to view the Fair One's Eyes and the Cœlestial Lamps, and to draw

Epistle Dedicatory. IV

draw a Parallel between her Bosom
and the *Milky-Way* ?

As my Book was originally design'd as an Account of the *MOON*, I shall inform you, Ladies, of some Adventures of mine in the *Cœlestial Bedlam* : But my first Admission there, first claims your Attention.

ABOUT a Twelvemonth since, I had accidentally cast my Eyes upon a blooming Beauty, and having been once before in Love, my Heart, Tinder-like, catch'd Fire at the Spark, and I crawled Home very light-headed and sick of an intellectual Fever. It happen'd, at that Juncture, to be the Full of the Moon : But, to shorten my Story, while I was walking with my Arms a-cross, and courting the distant Fair One in *Soliloquy*, something insensibly drew me

vi *Epistle Dedicatory.*

me upwards, till the Moon and I became contiguous. I need not mention how simple I look'd when, pulling out my Key to go into my Chamber, I found my self lost. I wander'd about some little Time, but being a familiar Puppy, I soon got Acquaintance with the best Families there, and at present I maintain a constant Correspondence with her lunar Majesty; however, I wou'd not have you suspect that I'm of her Privy Council: Tho' I may justly challenge some Intimacy with her, yet is she true to her nocturnal Trust, and inviolably conceals the numerous Intrigues committed to her Charge: In general indeed, she calls herself a Confidant to Amours in great abundance within the Verge of your County, but always waves the Communication of *Particulars.*

SHOU'D

Epistle Dedicatory. vii

SHOU'D the great Empress of the lunar Territories, upon a due Consideration of the Merits of this Treatise, constitute me her Secretary of State ; don't let it make you uneasy, Ladies, for I shall still be a Man of this World, nor do I propose ever to desert my present Method of Correspondence, which is transmitting Letters by the String of a *Paper-Kite* : But I shall be oblig'd to pay a monthly Attendance, *viz.* in the Full of the Moon, for then the Grandees sit, jolly, fiery-faced Fellows ; and (by the by) the Full of the Moon is nothing but the united Beams of so many Carbuncle Noses.

I'm sorry, Ladies, I can say but little detracting upon the Female Inhabitants of the Moon : Their Beauty falls prodigiously short of yours, tho'
not

viii *Epistle Dedicatory.*

not in so great a Degree as their Stature ; for her present Majesty's purple Robe sweeps the *Ground*, and is but seven Inches three Quarters long, tho' she is one of the tallest Women there. The frequent Depredations they suffer from formidable Swarms of Mice, is the greatest Calamity they lie under : To redress which, I innocently carried thither a Cat, like *Whittington*, for a Venture ; but the silly Animal mistook her Majesty's Life-Guard Men for Rats, and had devour'd thirteen of 'em before I cou'd interpose. This unhappy Accident abated something of the Royal Favour towards me, but I soon retriev'd it by presenting 'em with a Ring of Bells ; the Tenor was a *Dram-Glass*, and sounded very melodiously, but it prov'd a little too heavy. Their Canals are
excel-

Epistle Dedicatory. ix

excellently well stor'd with Fish, and the Inhabitants are pretty good Anglers; but, not long since, the Queen's eldest Son had inevitably been drown'd by an overgrown *Gudgeon*, if I had not plung'd in (almost Knee-deep) to his Rescue. I know you Ladies will disbelieve these Stories, or at least affect a Disbelief of 'em; (your usual Method of treating Young Men) but to shew the Probability of my Assertions, at my next Return from the Moon, I'll bring, ty'd to my Watch-String, *Curtail Spanbigh*, their famous Bear-Garden Champion.

THEY have excellent *Tea*, I must own, but I cou'd never like it, as not being recommended by a Dash of *Scandal*; 'tho' I have some Hopes of weaning 'em to the Fashion; for they can cheat at Cards already, and not a

B

few

X *Epistle Dedicatory.*

few of 'em have kept a *Cordial* in their Closets this three Months. I have made some few Profelytes to Play-Books, and laid a Scheme to make 'em relish what they don't understand a Word of; for I have taught one of 'em to sing *Italian* equal with *Cutzoni*. But her Majesty's Obstinacy in some Particulars, is really very *provoking*; for in spite of all my Remonstrances to the contrary, she obstinately persists in washing her Face with nothing but fair Water: Nor will all my Eloquence perswade her Grandmother to the Use of false Teeth. They are so far from admitting the Spleen and Vapours among 'em, that I can never make 'em understand the Terms. To instance once more how ill-bred they are, they never shew the least Affectation or Coquetry to a Lover, but
imme-

Epistle Dedicatory. xi

immediately disclose their Sentiments at the first Time of asking. They have an odd Way of saying their Prayers too in Church ; so that, in the Time of Divine Service, a Man can see no more of their Eyes than the Whites. They are surprizingly puritanical, and insist upon it, that *Tea* and Bread and Butter turn as much to Nourishment as Roast-Beef, and consequently may as reasonably claim a Grace. I have Orders to proceed no farther, upon Pain of her Majesty's Displeasure ; wherefore, as I have great Views there, I hope you Ladies will excuse my future Silence upon such dangerous Topicks : Since then I'm oblig'd to lay aside Lunacy, be perswaded, Ladies, nothing shall escape me but what *You* may claim a Share in ; and if I meet with your

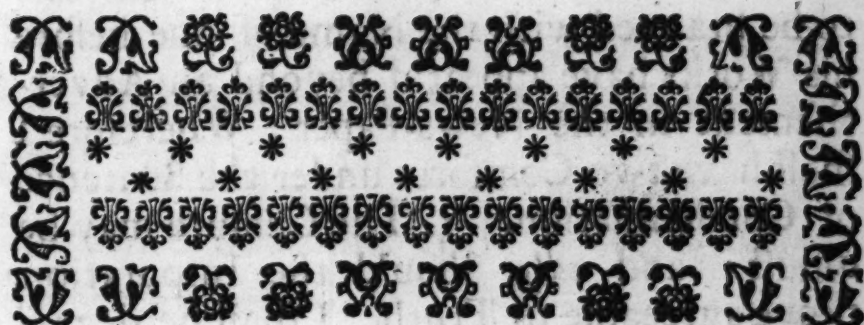
xii *Epistle Dedicatory.*

Approbation, undaunted, I'll stand
the Shock of critical Thunder ! I
have endeavour'd to please both
Sexes ; but if Applause can be gain'd
but on one Side, give me (at least)
my Choice : Then Smile, ye Fair
Ones, and I'm happy. But if I
shou'd unhappily meet a severe Cen-
sure from both Parties !----- Well ; I
won't think on't, because I don't ex-
pect it ; for you must know I'm a
very pretty Woman's Man : So that
you may justly conclude I am, and
ever shall be (till I sink into the
Gout, old Age, or the Grave)

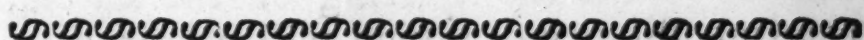
Right beauteous Ladies,

Tour most humble Vassal,

HANS DE VEIL.



A N
E S S A Y
T O W A R D S A
S O L U T I O N
O F T H E
Horizontal M O O N.



I N T R O D U C T I O N.



BELIEVE no Treatise ever appear'd under greater Disadvantages than this does: I have pitch'd upon a Subject which has foil'd abler Pens than mine, and tho' I treat of it in a new Method, I may probably meet the old Fate. A Sceptick in Philosophy is indeed an odious Character;

rafter; but it's many a Man's Misfortune to be branded with the Name of one before his Works have appear'd beyond an Advertisement in the News-Paper: Wherefore I shall have two Comforts under the Sentence of Condemnation. 1. The Censure may be unjust; and 2dly, Shou'd the Imputation prove agreeable to Truth, I shall be degraded (in this Respect) no lower than to a Level with *Wallis*, *Gassendus*, &c.

M E T H I N K S I want something which might prove a Counterpoise to Prepossession: The Subject of this Treatise has always been number'd among the greatest Difficulties, and as some of the greatest Men have fail'd in attempting an Explanation of it, 'tis no Wonder if my Solution of it is despised before it's read: But surely this is not like the squaring of the Circle, the Impossibility of which will admit of a Demonstration; whereas 'tis undeniably certain that this Phænomenon must be the Effect of something natural. You'll here see my Sentiments of the Matter, and I really think my Arguments conclusive; the World indeed must judge of that; but I shall stick to this Opinion till I see Demonstration against it. But perhaps Nobody will think me or my Book worth their Notice: Whereas in my Opinion, when a Person

son innocently attempts to propagate an Error, any Body that can ingenuously confute his Depositions, ought to reclaim him: Besides, the worst grounded Opinions never want their Votaries; wherefore a Demonstration against me wou'd probably be of Service to many; tho' I shall never believe there is Demonstration against me till I see it.

A M B I T I O N was what Influenc'd me most to the printing this; and *That*, I fancy, will, upon mature Deliberation, be found the greatest Spurr to Learning, and scarcely wou'd a Revolution of *Saturn* produce a Philosophical Treatise, were Writings condemn'd to appear anonymous.

I T is certain (as I said before) that the Phenomenon of the horizontal Moon must be the Effect of some natural Cause; and if any Person, by a lucky Guess, bids fair for a Solution of it, his Arguments shou'd be submitted to a candid Scrutiny, and his Reasons fairly weigh'd: But let no Man condemn this Opinion till he has examin'd it in *propria Persona*: A Man may then condemn it safely when his Reason points out to him an Absurdity; but to disapprove it upon *Hearsay*, is only thinking by Proxy, and resigning one's Soul to another's Jurisdiction.

BE-

BEFORE I proceed directly to the Purpose, *viz.* the Solution of the horizontal Moon by the Refraction of the Atmosphere, 'twill be necessary to look into another Hypothesis which has very much obtain'd of late; I mean that of *Rerum Longinquarum*: Those of lesser Note (as the Dilatation of the Pupil, Mr. *Hobbs's* Scheme, &c.) I shall pass by since they have been so thoroughly confuted: To the Question then in Hand, *viz.* *Whether the Phenomenon of the horizontal Moon is solv'd by the Interposition of distant Objects?*

Sect. 1. THIS Hypothesis is grounded upon the Diminution of the horizontal Moon's apparent Magnitude when seen through an empty Tube: for, as the Assertors of this Opinion tell you, the distant Objects, exhibited by the Horizon, make the Moon appear more distant in the Horizon than in the Meridian, and consequently larger: wherefore, as an empty Tube intercepts all those distant Objects, the Moon shou'd (as indeed it does) appear less through such a Tube than when seen by the naked Eye.

IF I understand the Hypothesis, I have stated it fairly; wherefore I shall proceed to object against it.

§. 2. THE

§. 2. THE meridional Moon appears less through a Hole prick'd in a Piece of Paper, than when seen by the naked Eye ; as will any luminous Body : I shall account for this in §. 17. But let it proceed from what Cause it will, if the meridional Moon is lessened by a fine Bore as well as the horizontal Moon, 'twill be evident that the horizontal Moon does not appear less because the distant Objects are intercepted by the Tube, and consequently that the Encrease of apparent Magnitude in the horizontal Moon does not depend upon the Interposition of distant Objects.

§. 3. A SHEET of Paper rightly placed wou'd intercept distant Objects : But tho' a Sheet of Paper be so placed as to intercept distant Objects, yet the Moon remains unalter'd ; therefore the Encrease of the horizontal Moon's apparent Magnitude cannot be owing to a Comparison between the Moon and those Objects, since the Moon appears equally large, whether the Objects are seen or not. To this the *Longinquists* answer ; that when you look at the horizontal Moon by such a Plan as a Sheet of Paper, you are still certain that the Objects are in *Statu quo*, and by Means of that Prejudice the Moon still retains it's apparent

C

Magni-

Magnitude. The Reply to this is almost too plain to be inserted; for surely the distant Objects leave as great an Impression on me, whether I direct my Eye-sight by a Sheet of Paper, or an empty Tube.

§. 4. THESE distant Objects bound our Horizon, and consequently all the cœlestial Objects in the horizontal Circle, such as the Moon, Stars, &c. must appear contiguous to those terrestrial Objects; there is therefore evidently a vast Interval (*viz.* that between the Moon and the distant Objects) cover'd or cut off when the Moon is in the Horizon: Whereas, as when it is in the Meridian, the whole Distance lies open to us: Whence, I conclude that those very Objects make the horizontal Moon appear nearer to us rather than more remote: All the Persons, unacquainted with Philosophy, whom I have consulted, and who are certainly the best Judges in this Case, have answer'd me agreeably to what I have laid down. If then the Moon appears nearer in the Horizon than in the Meridian without an Encrease of Angle, it ought, according to the Rules of Opticks, to appear least when horizontal.

§. 5. THE

§. 5. THE Moon appears differently large at different Times in or near the same Horizon. If this Assertion is true, I think the Hypothesis must fall; for 'tis a Maxim in Philosophy, that the same Effects will flow from the same Cause: But this Objection is too strong to be admitted; and they that espouse the Opinion of *Rerum Longinquarum*, always have and always must, either directly or indirectly maintain, that the apparent Magnitude of the horizontal Moon is unalterably the same in the same Horizon. Mr. *Mollineux* has averr'd the contrary; and what Views could he have in striving to impose a Deceit upon the World? I'm sure (if I can trust my Senses) I have observ'd a great Difference in the apparent Magnitude of the horizontal Moon, when I cou'd perceive none in the Horizon: But Men bigotted to an Opinion, shut their Eyes against the Truth: Accordingly the *Longinquists* tell you, "You are mistaken; you forget what Bigness the Moon appear'd of last Night:" tho' you fancy the Moon appears at least five Times greater or less than it did the Night before. Again, some that have more Conscience than to deny the Evidence of their Senses, tell you the Moon changes her Horizon every Night. True, she does so: But tho' the Horizon is chang'd,

C 2

the

the sensible Extent of it may remain unalter'd; and 'tis properly the *Length* of the Horizon which must influence the apparent Magnitude of the Moon: Besides, is it probable that a small Change in the Horizon (for it can't be a great one in two successive Nights) shou'd encrease the Moon apparently to five Times it's usual Diameter? 'Tis plain then, these are only Quibbles invented to serve an ill-grounded Hypothesis.

§. 6. To sum up these Objections in short.

“ I_F the meridional Moon is lessen'd as well as the horizontal, by being view'd through a small Aperture.

“ I_F the horizontal Moon retains its apparent Magnitude, tho' the distant Objects are intercepted by a Plan or a Sheet of Paper.

“ I_F distant Objects diminish the apparent Distance of the horizontal Moon.

And lastly,

“ I_F the Moon appears differently large when view'd at several Times in or very near the same Horizon;” what Reason, what Shew of Argument is there which may induce us to imagine that the Encrease
of

of the Moon's apparent Magnitude has a Dependance on her being compar'd with distant Objects?

So much against thy Hypothesis : Now for my own Opinion, *viz.* The Phænomenon of the horizontal Moon is owing to the Refraction of the Atmosphere : To make it evident,

First, I SHALL prove that the Atmosphere collects the Rays of Light, or makes 'em converge.

Secondly, FROM this collecting Property of the Atmosphere, I shall account for the Encrease of the Moon's apparent Magnitude as she approaches the Horizon.

Thirdly, I SHALL prove that the Angle ought to suffer no Alteration from Refraction.





PART I.

*The Atmosphere collects the
Rays of Light, or makes
'em converge.*

Sect. 7. **T**HE Sun generally appears in the Horizon while it is yet four Degrees below it. (That this is Matter of Fact, may be seen in *Derham's Physico-Theology*, Page the 13th, Edition the sixth, in the Notes.) This Phænomenon is undoubtedly the Effect of the Refraction of the Atmosphere. Now if the Sun appears in the Horizon when it is four Degrees below it; the Sun will also appear four Degrees (or thereabouts) above the sensible Horizon when it is in the rational Horizon: for the Sun has no Parallax, as seen from different Points of the Earth; or, which is all one, the sensible and rational Horizons coincide with Respect to the Sun. But
when

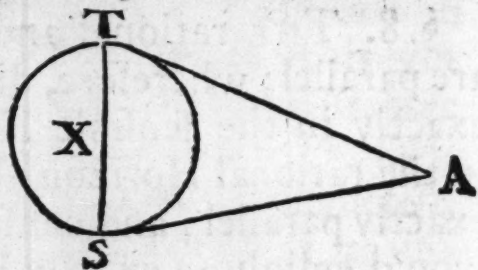
when we consider the Moon, we find that her horizontal Parallax is rather more than one Degree ; which must be substracted from the four Degrees of refracted Elevation : But was the Moon as distant from us as the Sun is, SHE wou'd likewise appear four Degrees above the sensible Horizon while she is yet in the rational Horizon ; because the two Horizons wou'd then coincide : Wherefore, after having substracted the Quantity of the parallaſtic Angle, *The Moon appears (nearly) three Degrees above the sensible Horizon, when she is really in the rational Horizon.*

§. 8. THE rational and sensible Horizons are parallel ; wherefore, did the Moon appear exactly in the sensible Horizon when she is in the rational Horizon, her Rays wou'd be exactly parallel ; and consequently the Moon wou'd enlighten exactly half the Earth : For a right Line intersecting two parallel Tangents in the Points of Contact, must go through the Centre of the Sphere, or bisect it : If therefore the Moon shou'd appear in the sensible Horizon while she is in the rational Horizon, the Plan of the Circle intersecting Light and Darknes wou'd go through the Centre of the Earth ; that is, just half the Earth wou'd be enlightened by the Moon : But if the Moon (as she really does)

does) appears three Degrees above the sensible Horizon when she is in the rational Horizon, she must enlighten a considerable Part of the Earth beyond the Plan which bisects the Earth : Therefore, *The Moon enlightens more than half the Earth.*

§. 9. IF the Moon enlightens more than half the Earth, 'tis evident that the Rays must come in a converging Direction : For, (as I said before) if the Rays were parallel, no more than half the Earth cou'd be enlighten'd : And if they came diverging, they could not enlighten so much as half the Earth, as will appear by the Scheme. If

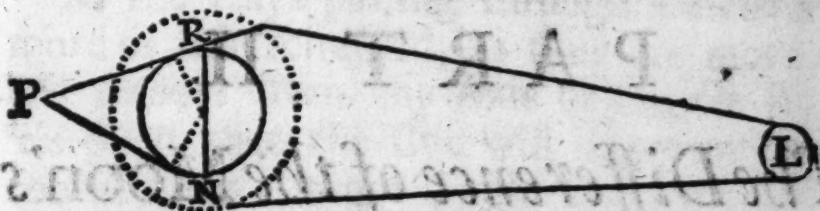
two Lines (or Rays) are drawn from the Point *A* as Tangents to the Circle *X*, 'tis evident they



can never touch the Extremities of the Line *T S*, which bisects the Circle, unless the two Lines first intersect the Circle : Since therefore the Moon enlightens more than half the Earth, *The Rays must come to the Eye (as well as to the Earth) converging.*

§. 10. IF the Rays come to us converging, they must tend to a Focus---But this will best appear by a Scheme. Let the Moon be at

at *L*, let the outer Circle be the Atmosphere, the inner the Earth: Now 'tis plain that the two refracted Rays which touch the Earth



beyond the bisecting Line *R. N*, meet at the Point or Focus *P*. To sum up these Arguments in short.

§. 11. WHEN the Moon is horizontal, she appears three Degrees above the Horizon—Therefore she must enlighten more than half the Earth—Therefore the Rays must come to us converging—Therefore there is a Focus behind us, and, *The Atmosphere collects the Rays of Light*. Quod erat demonstrandum.

§. 12. PERHAPS, it will be deny'd there is a Focus, because the Earth interposes: But if the Ray come to my Eye converging, it will produce the same Effect, as if they really did converge.





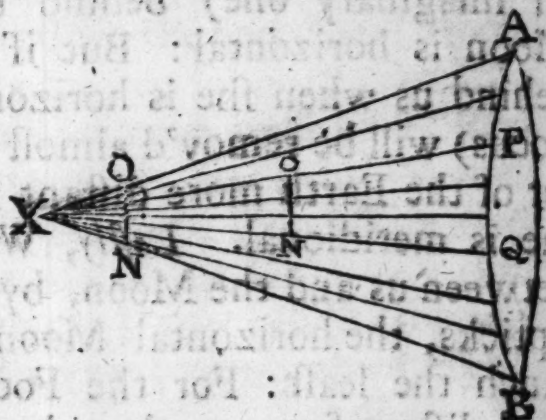
P A R T II.

*The Difference of the Moon's
apparent Magnitude is ow-
ing to our Change of Distance
from the Focus of the Moon's
Rays.*

Sect. 13. **I**T has been already prov'd that Rays of Light are collected by the Atmosphere, or inflected to a converging Direction: This collecting Property must proceed from the same Cause, (*viz.* Attraction) in Air as in Glafs: We may therefore justly compare the Atmosphere to a convex Lens in this Point. But an Object seen through a Lens encreases in apparent Magnitude, as the Eye recedes from the Lens towards the Focus of it's Rays. (*N. B.* I always mean a convex Lens.) This Property of a Lens is taken Notice of by *Robault*, (*Part 1. Cap. 33. §. 10.*) and the Reason, which he assigns for it is, in my
humble

humble Opinion, entirely agreeable to the Laws of Opticks. The Reason is this, "As the Rays passing through a Lens are more or less refracted, as they are more or less remote from the Axis or middle Ray, 'tis plain that the Eye will intercept Rays constituting a larger Angle as it recedes to the Focus?" But to make it more evident, see the Scheme, where *A. B.* is the Lens,

and *O. N, O.*
N, the Eye
in two different Situations: Now 'tis plain by the Figure, that where the Eye is



nearest the Focus, it receives the Rays *A X* and *B X*, which constitute a larger Angle than the Rays *P X* and *Q X*, which it intercepts in the other Position. If then a greater Inclination of converging Rays, or (which is all one) a nearer Approach to the Focus will occasion an Encrease of apparent Magnitude in an Object seen through a collecting Medium, and if the Atmosphere collects or renders converging the Rays flowing from the Moon, 'tis plain that her Encrease in apparent Magnitude must proceed from our Approach to the Focus of her Rays,

if it can be prov'd that her Focus is nearest Us when the Moon is nearest the Horizon; which is plain, because,

§. 14. THE Focus must be on that Side the collecting Medium which is opposite to the Object: Besides, as the Rays come to us converging, 'tis clear, even to Demonstration, that there must be a Focus (at least an imaginary one) behind us when the Moon is horizontal: But if the Focus is behind us when she is horizontal, It (the Focus) will be remov'd almost a Semidiameter of the Earth more distant from us when she is meridional. *Lastly*, Was the Focus between us and the Moon, by the Rules of Opticks, the horizontal Moon must appear much the least: For the Focus wou'd be most distant from us when the Moon is horizontal, and consequently we should receive Rays constituting a less Angle than when she is in any other Scituation. The Arguments then, for the two last Propositions, run thus.

§. 15. WHEN the Moon is in the Horizon, she appears three Degrees above it—Therefore she enlightens more than half the Earth—Therefore the Rays come to us converging—Therefore there is a Focus behind us—An Object appears largest through

through a collecting Medium when the Eye is nearest the Point of Convergence: But the Eye is nearest the Focus of the Moon's Rays when she is horizontal— Therefore, *The Encrease of the horizontal Moon's apparent Magnitude is owing to our Approach to the Focus of her Rays.* Quod erat demonstrandum.

Now I have given a demonstrative Solution (for such I think it) of the Encrease of apparent Magnitude in the horizontal Moon, 'twill be requisite to give some Reason why her Angle should remain unalter'd; for I shall suppose it to do so, since the Diminution of her Angle has been found proportionate to the Encrease of her Distance: The best Reason which I can assign for this Phænomenon, is a Proof of my third Proposition, *viz.*





PART III.

*The Angle ought to suffer
no Alteration from Re-
fraction.*

SECT. 16. **A** LENS interpos'd between the Object and the Eye (provided the Eye is between the Lens and the Focus) protrudes the Object, and makes it appear as a Portion of a more distant Circle: This is not a bare Assertion of my own; as may be seen in *Rohault*, (*Part 1. Cap. 33. §. 7.*) However it may easily be prov'd as thus. There are but two Reasons why the Magnitude of any Object appears encreas'd. *1st*, When the Object is brought nearer, and consequently subtends a greater Angle. *2^{dly}*, When, under some particular Circumstances, the Object appears more remote, and nevertheless subtends the same Angle. Refraction certainly encreases the apparent Magnitude of Objects one of these two Ways; but that it does not augment the Angle,

Angle, I thus prove. Let us suppose a Circle mark'd with 360 equal Divisions; each Division will subtend an Angle of one Degree: Instead of the surrounding Atmosphere, let us suppose within that Circle a concentrick one compos'd of 360 equal Lenses: In the Centre of these Circles let an Eye be plac'd. This Eye will perceive each of the Divisions, as it severally turns to 'em, magnified by Refraction to perhaps ten Times their unrefracted apparent Magnitude: But can any reasonable Man suppose their respective Angles equally enlarg'd? For, was it so, how many Degrees wou'd there be in a Circle! If a Circle cou'd be suppos'd to contain as many right Angles as such an Augmentation would occasion, where wou'd be the Truth of the Mathematical Maxim? "No more than four right Angles can be drawn about a Point." A Circle will be a Circle still, be it's Area never so much encreas'd; nor will a right Angle expand itself, tho' it's Arc or Subtense is made a Portion of a larger Circle. Allowing that the Eye can see through but one Lens at once; (as it has been objected to me) yet should an Angle of one Degree be magnified to that of two Degrees, the other Divisions might reasonably expect the same Favour; and wou'd not the Symmetry of the Circle be as much violated by the Admittance of
one

one new Degree, as by the Addition of a Thousand? Besides this, I know an Insect whose Head is encompass'd with a transparent Humour, design'd probably for Vision; and was this Creature placed in the Centre of the abovemention'd Circles, it wou'd certainly perceive the several Divisions equally magnified, that is, the whole Circle wou'd appear to it as farther remov'd; or (which is all one) increas'd by Refraction; for the Enlargement of a Circle can have no Effect upon the central Point. The Epitome then of this Proof runs thus: If Refraction cannot alter the Angles contain'd in a whole Circle, or drawn about the Centre, neither can it alter the Angle subtended by any Arc or Part of a Circle: But ev'ry Object (or rather the Diameter of it which we measure) appears as Part of a Circle, whose Radius is a Line drawn from the Eye to the Object. Therefore, *Refraction does not alter the Angle.*
Quod erat demonstrandum.

Now (tho' I think my Solution of the horizontal Moon fully prov'd,) I shall proceed to corroborating Circumstances, such as, if fairly attended to, will carry with 'em sufficient Evidence (almost) exclusive of the Proofs already laid down.

§. 17. WHEN the Moon (I say the Moon in general) is view'd through an empty Tube, I have observ'd that its apparent Magnitude is (*ceteris paribus*) directly as the Bore of the Tube, unless the Bore is too big or too little to cause any Difference. This I have hinted at §. 2. and to give a true and rational Account of this, we must consider that Light is attracted by all Bodies: But the smaller the Bore is, the stronger will that Attraction be; (*viz.* to the Sides of the Tube) and the exterior Rays of that Pencil which comes to the Eye of the Observer, will be more inflected from their Inclination, and consequently form a less Angle with each other; upon which Angle the apparent Magnitude depends. *Gravesend* (*Book 3d. No. 613.*) says, agreeably to what I have said, "It is also prov'd that that Action (*viz.* the Inflection of Light) is encreas'd as the Distance is diminish'd." Wherefore we may with Justice impute the Diminution of the Moon's apparent Magnitude (when seen through an empty Tube) to this Inflection of the Rays. How miserably this Diminution, &c. has been misapplied, may be seen §. 1.

§. 18. THE Moon's apparent Magnitude decreases as her Elevation encreases. This Phenomenon of the Moon is perfectly consistent

sistent with my Opinion, and, with Men of Candour and Ingenuity, will evince the Truth of it: For as the Moon's Distance from the Horizon gradually encreases, so does our Distance from the Focus, till, when the Moon becomes meridional, the Point of Convergence is farthest remov'd from us, and therefore the Moon shou'd then, as it really does, appear least. What can be plainer than this? If Men are in the least willing to admit the Truth, they can't avoid it here.

§. 19. THE Moon's apparent Magnitude is different at different Times in or near the same Horizon. Now this is a Phenomenon which cannot possibly be solv'd any other way than by my Hypothesis: I my self am convinc'd of the Truth of it, if our Senses may be trusted, but those that wont take my Word for it (as I'm a prejudiced Person) may take Mr. *Mollineux's*. My Principles will easily account for this extraordinary Appearance.—— For, our Distance from the Focus of the Moon's Rays will be inversely as the Convexity of that Part of the Atmosphere which is perpendicularly under the Moon: Therefore, as that Convexity is, such will be the apparent Magnitude of the Moon directly; and it's too evident to be deny'd, that a great many
Acci-

Accidents will encrease or diminish the Convexity of the Atmosphere. If these Proofs are insufficient, I must patiently submit to obstinate Prepossession: Tho' in my Judgment, *Euclid's* Demonstrations are not clearer: And I'll venture to argue as Sir *Isaac Newton* did for Gravitation.—“ If the Phenomenon of the horizontal Moon depended on the Refraction of the Atmosphere, such wou'd be the Effects; since therefore such are the Effects, the Refraction of the Atmosphere must be the Medium whereby to solve the Phenomenon of the horizontal Moon.” I shall now endeavour to take off such Objections as I have heard started against this Opinion.

§. 20. IT has been objected to me, that, when the Moon is horizontal, the Rays which we receive are so far distant from the Axis or Perpendicular, as to be unfit for optical Uses.

Answer. 'TIS true, those Rays, by which we perceive (or rather fancy) the Moon to be in our Horizon, are the most distant from the central Ray of the Rays which are regularly refracted; otherwise we shou'd see the Moon sooner: But as those Rays give us a distinct View of the Moon, they must be fit for optical Uses. I have several Times

cover'd a Lens all but the very Edge, and yet observ'd as great an Encrease in the Object's apparent Magnitude, by drawing my Eye toward the Focus, as if my Eye had been placed in the Centre of the Glass: Indeed the farther the Eye is remov'd from the Axis, the more distant will the Object appear from it's true Place.

§. 21. IT has been objected to me, that the Convexity of the Atmosphere is too small (*i. e.* the Atmosphere is too flat) for such a Refraction.

Answer. LET it be consider'd that, if the Earth was taken away, and it's Place fill'd with Atmosphere, an Object (as far distant from us as the Moon is) seen from the Focus through the whole Globe of Atmosphere, wou'd appear as large as the Atmosphere. I therefore think that so considerable an Approach to the Focus as (nearly) a Semi-Diameter of the Earth, may reasonably be allow'd sufficient to solve the Encrease of the Moon's apparent Magnitude.

§. 22. IT has been objected to me that, as the Atmosphere reaches beyond the Moon, the lunar Rays can meet with no refracting Surfaces.

Answer.

Answer. I SHALL not lose Time in confuting the Minor of the Proposition; but I must give a small Hint about Retardation of planetary Motion: But if we look into the Consequence, we shall find it as unphilosophical as the Minor: For as the Atmosphere encreases in Density as it is nearer the Earth, every Ray at any Distance from the Axis (*i. e.* the Ray which points to the Centre of the Atmosphere) will describe a Curve, and impinge upon perpetual refracting Surfaces.

§. 23. IT has been objected to me that, as an Object seen through a Lens with both Eyes appears double, so ought the Moon through the Atmosphere, since I have acknowledged (§. 13.) that the refracting Power proceeds from the same Cause in Air as in Glass.

WHEN I first learn'd this Phenomenon of a Lens, I own it startled me; but I thought my Opinion too well establish'd to fear any Objection, unless it was Demonstration, against me: For an unanswerable Difficulty is no Proof that a Man is in the wrong, tho' it may put him to a Stand. I have now two Solutions of this Difficulty; either of them sufficient to take off the Objection.

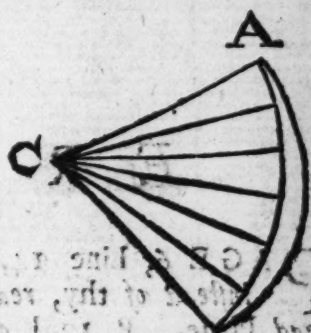
Ans.

Ans. 1. THE Moon (say my Adversaries) ought to appear double: True, it ought so, not because we see it through a convex Medium, but because we see it with both Eyes; nay, more, it really does so; but by Prejudice we judge it single. I have good Reason to believe this: For a very eminent Surgeon inform'd me, that a Patient of his by an Accident had one of his Eyes so much distorted, that he could not see with it; but upon the Restitution of his Eye, ev'ry Thing appear'd to him double, till by Degrees Objects became familiar to him, and at last exhibited severally but one simple Appearance. The Gentleman farther inform'd me, that he had never met with a Body (tho' he dissected several) in which the optick Nerves met; wherefore he justly concludes that Prejudice is the sole Cause why the two Images on the Retinas produce but one Sensation. I my self have observ'd, that the longer I look at an Object with both Eyes through a Lens, the two Representations draw nearer and nearer.

Ans. 2. THE single Appearance of the Moon is owing to the single refracting Surface of the Atmosphere: By this I mean, that the Rays, in passing through the Atmosphere to the Eye, suffer no Refraction but on that Side of the Atmosphere next the

the Moon: The other Side which is next the Eye, is contiguous to the Eye, and the Rays, when they emerge from the Air, do not alter their Direction before they reach the Eye: Whereas Rays of Light, in passing through a Lens, are refracted by both Surfaces: But if a Lens was so contriv'd as is represented in the following Scheme, I dare be bold to say an Object seen through it wou'd appear single. Let

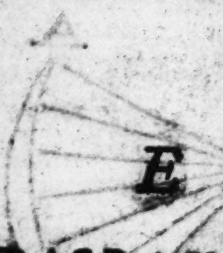
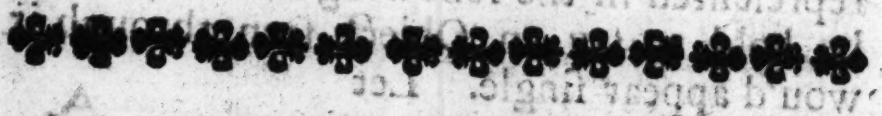
A. B. be a concave-convex Lens, and *C* the Focus. I have made the Focus to be the Centre of the Sphere of which the concave Surface is a Portion, so that ev'ry Ray which tends to the Focus, falls



perpendicularly on the concave Surface, and consequently suffers no Refraction by it. That a Lens refracts on both Sides, and the Atmosphere but on one is the only material Difference I could find between the Atmosphere and a Lens; to that therefore I impute the different Appearances of Objects seen through 'em: Besides, there is some Analogy between their respective Surfaces, and the Appearances which they generally exhibit.

F I N I S.

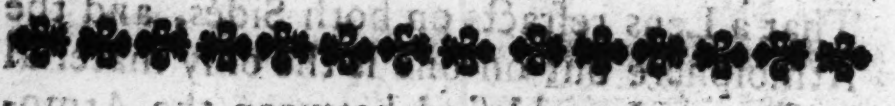
the Moon: The other Side which is next
 the Eye, is contiguous to the Eye, and the
 Rays, when they emerge from the A, do
 not alter their Direction before they reach
 the Eye: Whereas Rays of Light, in passing
 through a Lens, are reflected by both Sur-
 faces: But if a Lens was so contriv'd as is
 represented in the following Scheme, I dare



ERRATA

PAGE 6, Line 14, *leave out the Word as.* P. 6. l. 24.
Instead of thy, read this. P. 11. l. 25, *instead of Plan,*
read Plane. P. 12. l. 4, *ditto.* P. 13. l. 1, *last but two, for*
Ray, read Rays.

tends to the Focus, falls
 perpendicularly on the concave Surface, and
 consequently suffers no Reflection by it.



is hence I could find between the Armo-
 nious and a Lens; to that therefore I impute
 the different Appearance of Objects seen
 through it: Besides, there is some Analogy
 between their respective Surfaces, and the
 Appearance which they generally exhibit.

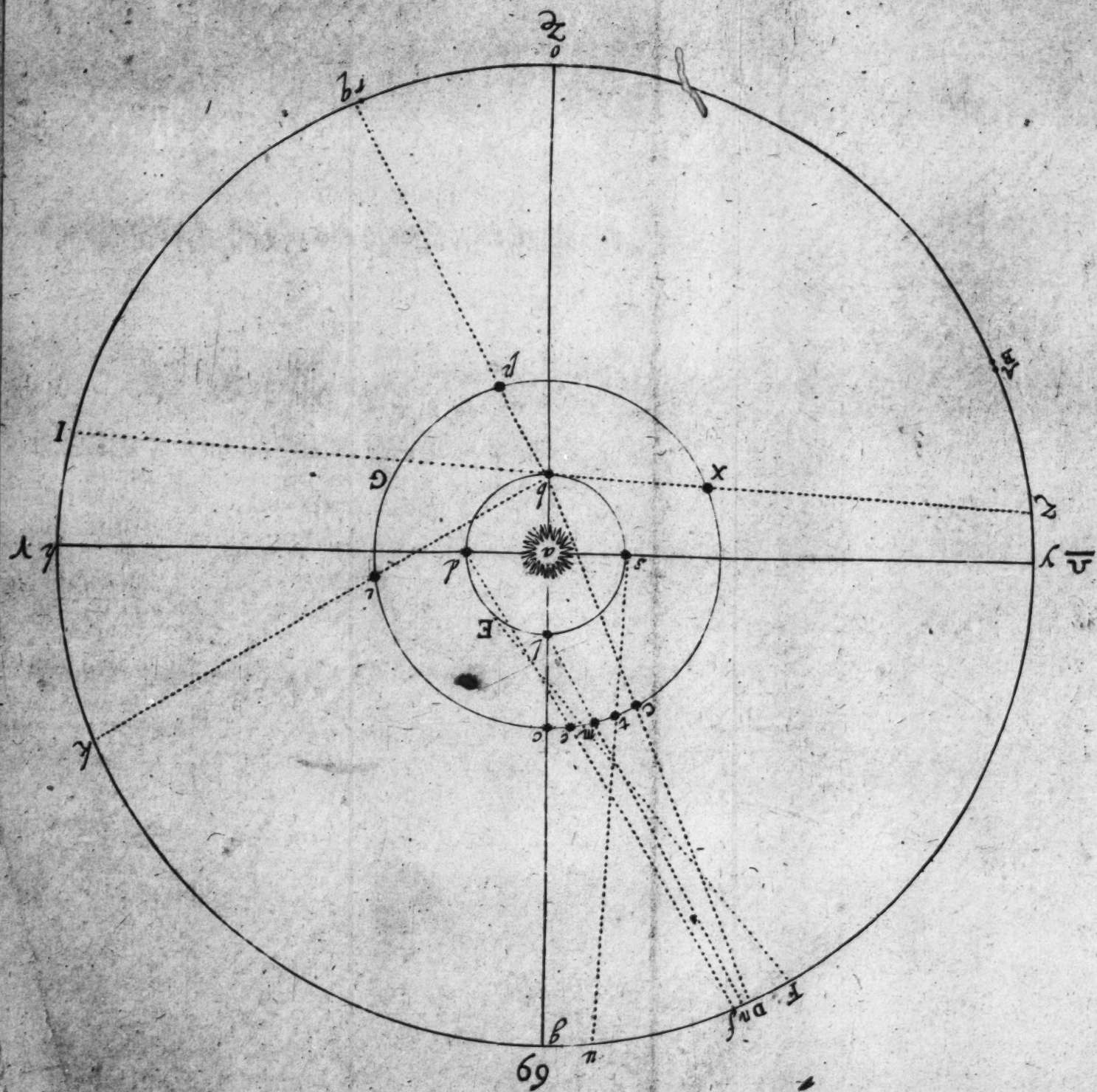


Fig. II.

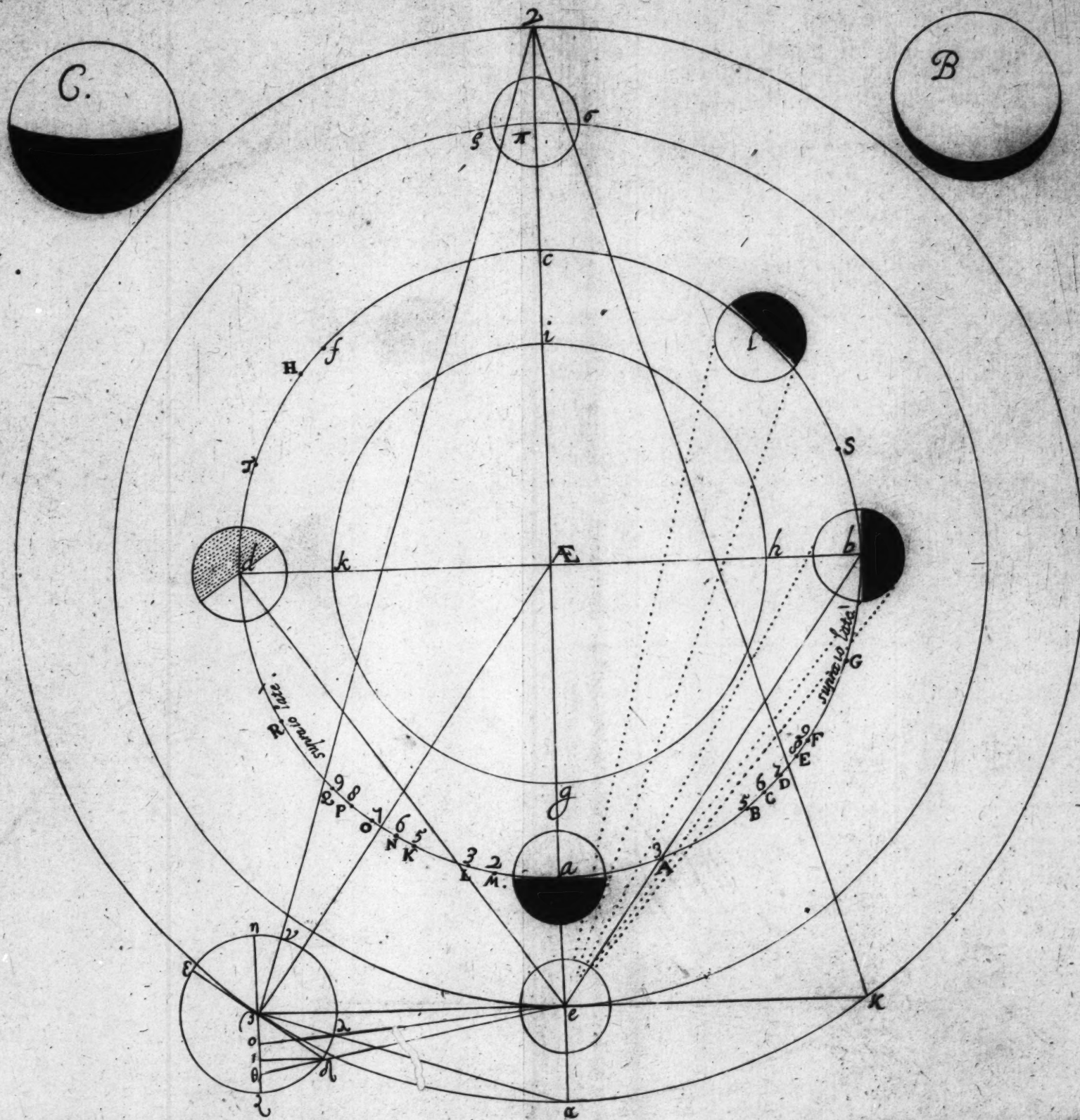


Fig. III.

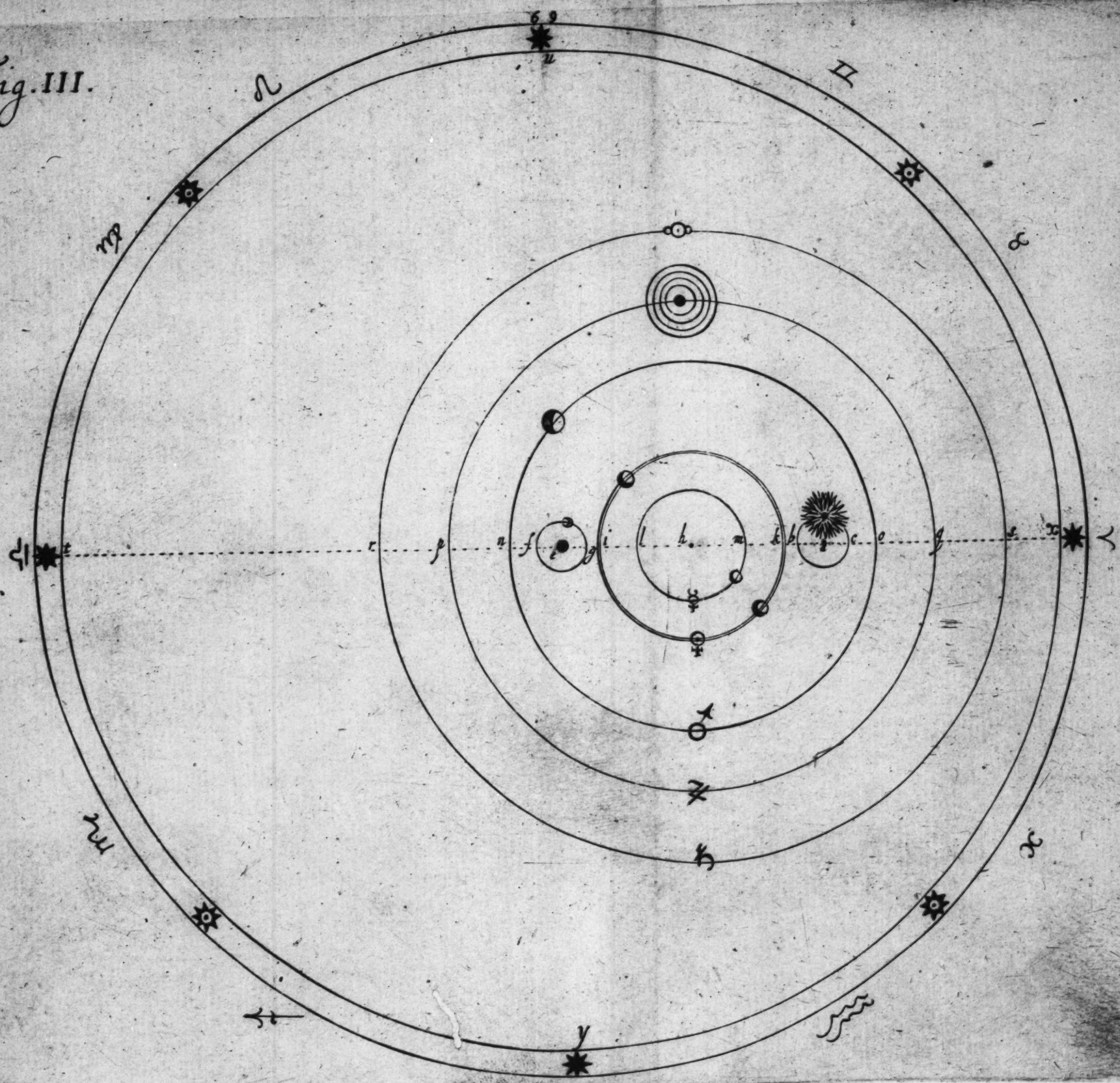


Fig. III.

aeftatis

tempore

brumae

